
Contributions of Data

GSL routinely collects, builds and archives Global Earth Observing System of Systems (GEOSS) and national datasets through its development and support of the Meteorological Assimilation Data Ingest System (MADIS). Additionally, GSL collects, quality controls, and archives specialized datasets for research purposes. Contributions to national and international-related databases and programs, and involvement in international quality-control activities to ensure accuracy, precision, inter-comparability, and accessibility of global datasets are described below.

MADIS

The U.S. contribution to GEOSS is the Integrated Earth Observation System (IEOS). The Architecture and Data Management Working Group for the IEOS has listed GSL's Meteorological Assimilation Data Ingest System (MADIS), which was transitioned to operations at the National Weather Service's (NWS) National Centers for Environmental Prediction (NCEP) Central Operations (NCO) on January 21, 2015. Research and development of MADIS continues at GSL, and the MADIS archive is now hosted by NOAA's National Centers for Environmental Information (NCEI). MADIS is designed to collect, integrate, quality control (QC), and distribute observations from NOAA and non-NOAA organizations. MADIS leverages partnerships with international, federal, state, and local agencies; universities; volunteer networks; and the private sector (e.g. airlines, railroads) to fill gaps in NOAA's observations. The integration of observations from these partnerships help to provide a finer-density, higher-frequency global observational database for use by the greater meteorological community. MADIS is now a national asset for improving meteorological observations, the delivery of observations, as well as improving the on-going archive of the data and metadata at NCEI.

MADIS was transitioned to operations at NCEP as part of the Integrated Dissemination Program (IDP). and now provides the framework for adding additional observation system capabilities and services. Since 2016, three observations systems have been integrated into MADIS:

1. The Hydrometeorological Automated Data System (HADS)
2. The Automated Flood Warning System (AFWS)
3. Ans Clarus - The Department of Transportation's (DOT) Road Weather Information System (RWIS)

MADIS services now include being the World Meteorological Organization's (WMO) Global Data Center (GDC) for acquiring Aircraft Based Observations (ABO).

MADIS improves observations by Quality Controlling the observations on receipt of the data. MADIS Quality Control (QC) is being improved in three ways:

1. Improving the understanding of the data through the collection of more complete metadata by working with programs such as:

- a. The National MESONET (NM) program on metadata standards such as Open Geospatial Consortium's (OGC) SensorML and Starfish Fungus Language.
 - b. Sensing Hazards with Operational Unmanned Technology (SHOUT) program on ISO metadata standards.
2. Using the improved metadata to improve the QC algorithms based on a better understanding of the data.
3. Providing an open source framework and a process for the meteorological community to help improve the QC algorithms used by MADIS.

MADIS improves the delivery of the observational data to the meteorological community by acquiring and decoding data from a wide array of platform types and providers, handling the disparate formats and multiple protocols and encoding the observational data into a common format with standard units and time stamps, and delivering the data via a set of standard services.

MADIS is working with several programs to improve the delivery and discovery of MADIS data:

1. The Next Generation IT Web Services (NGITWS) program on OGC delivery and discovery services such as Web Feature and Web Coverage.
2. The NWS Data Delivery (DD) program on OGC WFS discovery and delivery services.
3. The SHOUT program on ISO discovery and delivery services.

Distribution of MADIS to the greater meteorological community encompasses delivery to 19 national meteorological centers, including NCEP, the European Center for Medium-Range Weather Forecasts (ECMWF), the United Kingdom's National Weather Service (UK Met Office), the Korean Meteorological Administration (KMA), Taiwan's Central Weather Bureau (CWB), EUROCONTROL (European Organization for the Safety of Air Navigation), and the Chinese and Finnish Meteorological Centers. For more information about MADIS, go to <https://madis.ncep.noaa.gov/>.

GPS-Met

GSL GPS-Meteorology's data processing system using ground-based Global Positioning Satellite (GPS) receivers collected data that estimate atmospheric water vapor/precipitable water and are used in NWS operational models and NESDIS Total Precipitable Water (TPW) products and algorithms. GSL developed a comprehensive Statement of Work detailing technical requirements and objective quality testing criteria for the system. GSL worked with the National Weather Service to translate this SOW into a Request for Proposal, which was then advertised and a vendor was selected to provide TPW estimates for all NOAA Line Offices. A contract was awarded and in October 2016 NWS began distributing TPW estimates in its Operations. In November 2016, GSL terminated its TPW processing and the gpsmet.noaa.gov websites, and in 2017 the gpsmet hardware was disposed of by transfer to other NOAA agencies or through a surplus process. In December 2020 GSL responded to NWS's request for guidance while it prepared a new RFP due to the existing five year contract's September 2021 end date.

Science On a Sphere®

Science On a Sphere® (SOS) has established a substantial catalog of datasets that is distributed to each site that installs the system. The catalog includes the categories of Air, Water, Land, Snow and Ice, Space, People, and Extras. The catalog now comprises over 550 datasets, including 45 real-time datasets and 99 narrated movies. There are also 150 datasets that are compatible with SOS Explorer, the flat screen version of SOS. The collection continues to grow as new contributions come in from a wide variety of sources including NOAA, NASA, universities, and sites that have SOS. Additional users of the catalog include planetarium users, other spherical display users, publishers for books and movies, and teachers. Datasets are also shared through the SOS social media channels, which garner a large following. The catalog can be found here: <http://sos.noaa.gov/Datasets/>.

HIWPP Open Data Initiative

The High Impact Weather Prediction Project (HIWPP), led by GSL, was one of the larger projects funded by the Disaster Relief Appropriations Act of 2013 following Hurricane Sandy to address the challenge of developing the world's best medium range weather forecast model. The project ran from July 2014 until July 2017 and coordinated research across 6 NOAA laboratories/centers and 3 Cooperative Institutes, plus NCAR and NRL, addressing multiple aspects of modeling and development of tools to support model evaluation, and resulting in 10 peer-reviewed publications. Some of the major accomplishments of the project included advances in model physics packages, initiating the process of evaluating candidate non-hydrostatic dynamical cores, evaluating Graphical Processing Units (GPUs) for advances in HPC, expanding the NMME seasonal ensemble suite, developing a moving nest capability for hurricane modeling, and building innovative tools for visualization, verification, and data dissemination. GSL researchers made significant contributions in the areas of model physics, evaluation of non-hydrostatic dynamical cores, evaluating GPUs for HPC, and the development of innovative tools for model evaluation. The work initiated under HIWPP continued under the Next Generation Global Prediction Project (NGGPS) and the UFS R2O projects.

NOAA Environmental Data Management Committee (EDMC)

GSL researcher Kirk Holub serves as the GSL representative on the EDMC. The Environmental Data Management Committee (EDMC) coordinates the development of NOAA's environmental data management strategy, and policy, and provides guidance to promote consistent implementation across NOAA, on behalf of the NOSC and CIO Council. Environmental data management is an end-to-end process that includes acquisition, quality control, validation, reprocessing, storage, retrieval, dissemination, and long-term preservation activities. The goal of the EDMC is to enable NOAA to maximize the value of its environmental data assets through sound and coordinated data management practices.

Forecast Impact and Quality Assessment

Through cutting edge and innovative research, the Forecast Impact and Quality Assessment Services Branch of GSL provides operational agencies with technology and tools for improving

the accuracy and quality of weather information at critical operational decision points, thus improving services to the public.

An interdisciplinary team of meteorologists, physicists, mathematicians, and engineers provides meaningful quality assessment measures, network-enabled verification services for automated decision support and verification system unification, and independent comprehensive analyses to interpret and communicate the accuracy of weather forecasts.

WMO-Aircraft Based Observations

In the last several years, GSL scientist Bill Moninger has served as an invited participant as a “U.S. Technical Expert” for the World Meteorological Organization’s (WMO) Automated Meteorological Data and Reporting (AMDAR) panel. AMDAR is the set of automated upper-air weather reports from commercial aircraft. AMDAR provides about 750,000 measurements of wind, temperature, and some turbulence and vapor information, per day. These data are critical inputs to numerical weather prediction (NWP) models.

NOAA Web Committee

GSL researcher Kirk Holub participates on the NOAA Web Committee, which provides coordination and guidance for communicating NOAA information and data using online tools for the overall NOAA Web enterprise. The Committee formulates policy recommendations to the NOAA CIO and Director of Communications and acts as an advisory body to the NOAA CIO Council. The Committee provides support for the development and execution of NOAA Web-related enterprise-wide projects as well as those Web-related policies passed by the DOC/NOAA CIO and Director of Communications. The Committee may also serve as an advisory body to other NOAA committees and groups.